MARITIME HERITAGE MINNESOTA

Ann Merriman Christopher Olson



McLeod County Historical Society

Big Swan Dugout Canoe: 3D Scanning and Radiocarbon Testing Project



Acknowledgments

Maritime Heritage Minnesota thanks the staff, members, and volunteers of the McLeod County Historical Society for the opportunity to further investigate the Big Swan Dugout Canoe. In particular we appreciate the efforts of Lori Pickell-Stangel and Carla Hooper. We also thank Ken Schumann for his time and knowledge concerning the discovery of the Big Swan Dugout Canoe.

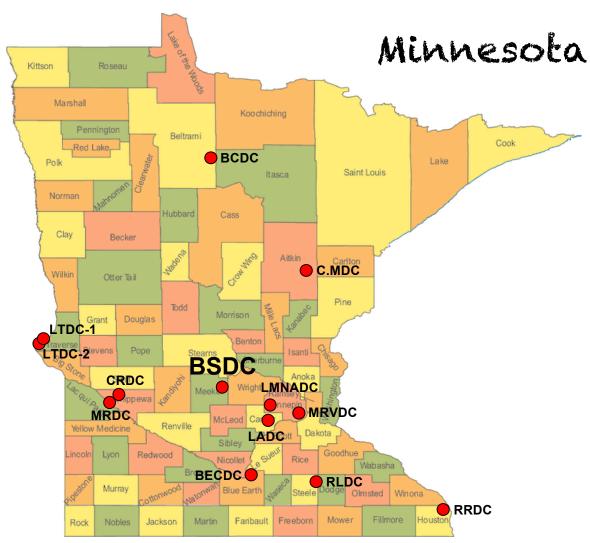
In September 2016, Maritime Heritage Minnesota was awarded an American Association for State and Local History Leadership in History Award of Merit for the Minnesota Dugout Canoe Project.

The Big Swan Dugout Canoe had a significant role in that research and the award is shared with the McLeod County Historical Society.



Introduction

Maritime Heritage Minnesota (MHM) conducted the Minnesota Dugout Canoe Projects 1, 2, and 3 (MDC-1-3) in 2013-2016. Those projects reported on 13 dugout canoes documented by MHM. The dugouts were measured, photographed, drawn, and small wood samples were taken for dating purposes. The samples were tested using Accelerator Mass Spectrometry to determine their probable ages by radiocarbon dating. The results allowed MHM to align the dugout canoes into a chronological series of Minnesota's oldest known watercraft and to define the probable cultures that produced them. The Big Swan Dugout Canoe (21-ME-37) played a major role in this work and its continued study is valuable to Minnesota's maritime history.

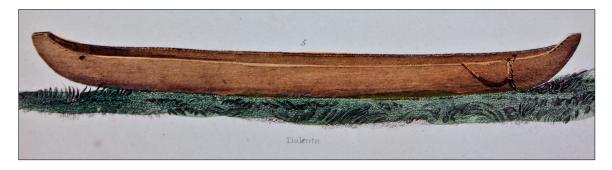


Geographic locations of dugout canoes that have been documented and studied by MHM.

BCDC (Beltrami Country Dugout Canoe, Borden Lake, Beltrami County Historical Society), C.MDC (C. Maki Dugout Canoe, Dutch Lake, Aitkin County, Cokato Museum), LTDC-1 (Lake Traverse Dugout Canoe-1, Browns Valley Historical Society), LTDC-2 (Lake Traverse Dugout Canoe-2, South Dakota Historical Society), CRDC (Chippewa River Dugout Canoe, Chippewa County Historical Society), MRDC (Minnesota River Dugout Canoe, Chippewa County Historical Society), BSDC (Big Swan Dugout Canoe, Big Swan Lake, Meeker County, McLeod County Historical Society), LMNADC (Lake Minnetonka North Arm Dugout Canoe, West Hennepin History Center), MRVDC (Minnesota River Valley Dugout Canoe, Bloomington Historical Society), LADC (Lake Auburn Dugout Canoe, Carver County, Minnesota Historical Society), BECDC (Blue Earth County Dugout Canoe, Blue Earth County Historical Society), RRDC (Rice Lake Dugout Canoe, Steele or Dodge County, Dodge County Historical Society), RRDC (Root River Dugout Canoe, Houston County Historical Society).

Dugout Canoe Use in Minnesota

With no supporting artifacts associated with the known Minnesota dugout canoes, it is necessary to depend on historical sources for context. Descriptions of dugout canoes constructed and used by Native American tribes and Europeans exist from 1835 to the early 1850s in the form of travel diaries and in watercolor paintings and pencil sketches by artist Captain Seth Eastman. In 1834, George W. Featherstonhaugh traveled by steamer, train, horse, and canoe from the East Coast to the source of the 'Minnay Sotor', or St. Peter's River. In 1835, on his way back east, Featherstonhaugh spent time in Wisconsin and complained about his lake travels in a dugout canoe. As he described it, it "was a wretched, tottering affair, imperfectly hollowed out of a small log, and wabbled about in such a doubtful manner that we had been several times near upsetting in crossing the lake. In this 'dug-out'...I had taken my seat on the bottom near the prow, with my face towards the stern, holding the sides with my hands" (Featherstonhaugh 1847, 102).



A rare depiction of a mid-19th Century Minnesota dugout canoe (by Seth Eastman, Schoolcraft 1852, Pl. 72.5, digitized by MHM).

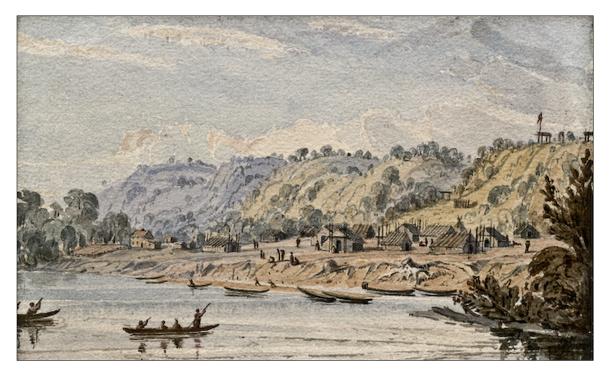
Another first-hand account of dugout use comes from Count Francesco Arese who traveled Minnesota's waterways during 1837. At Traverse des Sioux on the Minnesota River, known to Arese as the St. Pierre River, he traded his horse to two Native Americans for what he described as a "small boat", also characterized as a "canoe" of unknown design. Arese took to the Mississippi River with two Canadians in a dugout canoe, and described their craft as "a wooden one made of a tree trunk. It was 30 or 35 feet long and form 1/2 to 2 broad. When I was sitting on the bottom of it...I had a hard time moving, for the great trouble with such canoes is that they are very unsteady and a fairly heavy wave fills them at once. A person not accustomed to them hardly dares to move; but in a short while you learn to turn in every direction without making them lose their balance" (Arese 1934, 110, 118, 129).

Santee Dakota physician and author Charles Eastman (Ohiyesa) contended that Native Americans constructed dugout canoes when birch bark was not readily available. A suitable tree to fell would be chosen carefully, with soft maple, basswood, and cottonwood being the most appropriate to create a craft 12-16 feet long. During the prehistoric period the bulk of the inside of the trunk would be burned out to remove the majority of the wood and then finished with stone tools. The outside of the hull would have been smoothed with bone knives or sharp shells. With the introduction of metal tools in the historic period, the tree trunk would be smoothed on the outside into a boat shape and athwartships cuts were made about one foot apart down the length of the

log. The wood between these cuts would be split longitudinally and removed, and then hollowed out more with a pickaxe and smoothed by a chisel. Eastman described the thickness of the dugout canoes hull to be four to six inches and determined that knives smoothed the outer hull. Although not mandatory, fire was sometimes used to dry the hull and polish it. Eastman held that many Native Americans preferred dugouts to birch bark canoes because they believed them to be faster, more durable, and in the historic period they were easier to make due to the availability of better tools. Eastman believed that "the forest Indian alone still clung to the bark canoe". Finally, Eastman stressed one aspect of using dugout canoes - they were not intended for use by the novice. He contended dugouts were "very graceful in the hands of an expert Indian canoeist" (Eastman 1914, 49-51). This facet of craft might explain that handling the derision Featherstonhaugh and Arese held for their dugout canoe transportation.



An artist's watercolor rendering of dugout canoe construction using fire (Klammerer 1934-1935, 88).

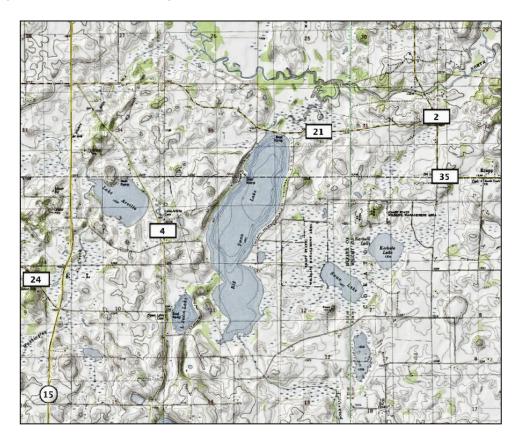


Little Crow's Village on the Mississippi River. MHM contends the majority of the canoes depicted here are dugouts due to the lack of sharply upturned ends shown. Watercolor by Seth Eastman (MNHS, AV1991.85.33).

Big Swan Dugout Canoe (21-ME-37)

Big Swan Lake, Meeker County

Big Swan Lake encompasses an area of 772 acres and is in east central Meeker County. The majority of the lake is 25 feet deep or less, the southern section of the lake is 5-10 feet deep, and the northern section of the lake deepens to about 32 feet. The lake is part of the Collinwood Creek Watershed, a system that includes 35 lakes in three counties – Meeker, McLeod, and Wright. The creek runs northward from Hook Lake in McLeod County to the North Fork of the Crow River southeast of Kingston in Meeker County (Anderson 2010, 62-71).

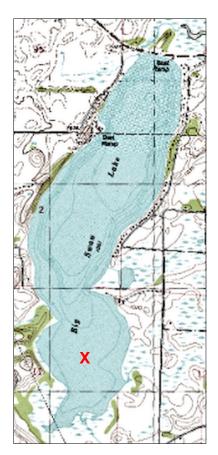


Big Stone Lake in Meeker County, near the western border of Wright County (USGS 1982).

The Discovery

Christopher Olson of MHM conducted an oral interview with Hutchinson resident Ken Schumann, a former employee of the Minnesota Department of Conservation, Fish and Game Division, who was present when the BSDC was found. The interview took place on December 22, 2016 over the phone. The following account stems from that interview. In late November 1957, about 15 State workers cut through 4 inches of ice on Big Swan Lake to fish for carp using a seine – or drag – net. They began working at 7 am in the southern section of the lake, cutting holes in the ice about 100 feet apart; they used an ice jigger to thread a rope from one hole to the other. The 3,500-foot dragnet was attached to the rope from west to east and the crew dragged it along the bottom to snare fish; their goal was to remove carp from the lake. Between 11 am and noon, the seine was pulled out of the water onto the ice. With it, the crew snagged 175,000 pounds of fish – and one dugout canoe that tore a 15-foot hole in the net. The workers

recognized the watercraft for what it was and disentangled it from the seine; unfortunately some of the crew cut off pieces as souvenirs. The dugout was left on the ice for two days until 12 workers hoisted it onto a truck; six of them drove it to the McLeod County Fairgrounds for storage. The artifact was transferred to the McLeod County Historical Society (MCHS) where it has been housed since mid-January 1958. In 2003 the site in Big Swan Lake where the BSDC was found was given a site number, 21-ME-37, during a survey of Native American artifacts found throughout the Minnesota. This number was provided by the Minnesota Office of the State Archaeologist because a researcher determined the exact location where the dugout was pulled from the lake mud by the seine (*Hutchinson Leader* 1958; *The Independent Review* 1958; Munter 2003).





Left: The Big Swan Dugout Canoe site is marked by the red X (USGS 1982).

Right: The Big Swan Dugout Canoe as it looked just after it was removed from the Meeker County lake and moved to Hutchinson (*The Independent Review* 1958).

¹The artifact was removed from Meeker County because the work crew did not give any thought as to who would 'own' the dugout. The dugout canoe fell under the 1954 *State vs. Bollenbach* ruling, meaning the State of Minnesota owned the dugout canoe. However, Minnesota did not have a State Archaeologist until 1963 and the State Historic Preservation Office was not established until 1969. Therefore, there was no State Office to report the discovery of the artifact or decide its fate. Further, the canoe could not have been taken to the Meeker County Historical Society/Museum because it was not established until 1960.

Dugout Canoe Description

MHM first documented the BSDC on 22 December 2013 for the Minnesota Dugout Canoe Project and again on August 25 and September 1 in 2016. The artifact is 14.25 feet long, 1.95 feet wide, has a .6-foot depth of hold amidships, and the canoe's sides are partially deteriorated. The outer hull of the BSDC is rough, with numerous knots from the source tree still visible. This attribute may indicate that the canoe was hastily constructed since the builder did not spend time to fashion a sleek hull that would move more efficiently through the water; the builder might have been short on time and needed a watercraft quickly. Both rounded ends at what could be considered the turn of the bilge were formed by placing an open fire under them. The fire slowly burned the squared-off ends of the log into a rounded hull at both ends that would move through water more easily and efficiently in comparison to square ends.



The Big Swan Dugout Canoe on exhibit at the McLeod County Historical Society in 2013 (MHM).





These two views of one end of the Big Swan Dugout Canoe illustrate the rounded nature that the original tree trunk was formed into by its builder using fire to slowly burn it into shape from below (MHM).

Artifact Condition

Considering that the BSDC was removed from its context, weakened by souvenir hunters, and allowed to dry in uncontrolled conditions, it is in relatively stable condition. A large section at one end of the canoe has broken off and the artifact is severely checked because of the uncontrolled drying; the potential for further fragmentation is possible. When MHM documented the canoe is 2013, it was displayed on a platform on the floor with no other barrier to prevent people from touching or climbing on it. Fortunately, since MHM first studied the canoe, the MCHS has placed the BSDC into a custom designed and constructed case that insures its safety into the future.



A section of the dugout canoe's hull showing the severe checking and damage of the outermost layer of wood (MHM).

Sample Collection and the Radiocarbon Dating of Dugout Canoes

The Big Swan Dugout Canoe: 3D Scanning and Radiocarbon Testing Project was designed to further document the BSDC to affirm and augment results from a previous dating project. In 2012 a wood sample taken from the BSDC underwent a radiocarbon test (14C) using Accelerator Mass Spectrometry (AMS) conducted at the Beta Analytic Laboratory (BAL). Data sheets from BAL listed the canoe's 'Conventional Radiocarbon Age' (CRA) in the form of a 'number of years ± a number of years BP' (Before Present); in this context, 'Present' is the year 1950. The CRA must be calibrated - corrected because the ratio of 14C to 12C - the component used to calculate the age of artifacts using radiocarbon – in the world's atmosphere is not constant over time (Aitken 1990. 66-67). A dataset of calibrated radiocarbon samples has been compiled over the decades since the mid 1960s. This database has been augmented over the years and the most recent calibration curve for the Northern Hemisphere available for correcting 14C data is 2013. Therefore, the BSDC results produced by BAL in 2012 were recalibrated by MHM using the updated standard in 2013. MHM used the online database provided by Oxford University (OxCal) to calibrate the CRA of the two new wood samples to a 99.7% (2 Sigma) probability; this system also produced a median date

range taking the 99.7%, 95.4% (2 Sigma), and 68.2% (1 Sigma)² probabilities into account. The BAL sample had a calendar age of AD 1030-1220 (900±30 BP) according to the 2009 standard. The re-calibrated calendar age of the BSDC using the 2013 standard and the results from BAL is AD 1039-1210.

On August 25, 2016, MHM collected two samples from the BSDC in order to obtain AMS 14C results from two additional labs. This goal was accomplished through the extraction of two small wood samples from the bottom of the dugout using small drill bits of slightly different sizes. A pilot hole was created to a depth of ¼ inch with the larger bit; the wood shavings that accumulated were discarded. The smaller bit was inserted into the pilot hole and it drilled further into the wood. These shavings were caught in foil and kept sterile in a sealed plastic bag, producing wood shavings clear of contaminates. Approximately 100 mg of shavings were collected. This process was repeated for the second wood sample in a different section of the dugout. The samples were sent to PaleoResearch Institute (PRI)³ and Geochron Laboratories (GL) for analysis. The reasoning behind collecting two samples was to confirm the validity of the radiocarbon test results produced by BAL.

MHM received the AMS 14C results from PRI and GL in October and December 2016; PRI also re-confirmed⁴ the dugout canoe's wood type: white oak (Geochron Laboratories 2016; Peter Kováčik 2016, 4)⁵. MHM calibrated the CRA through OxCal and produced results that confirmed the basic age of the BSDC, with a shift in its calendar age. The calibrated calendar dates provided below represent the date ranges that have the highest probability of being correct within the technology available:

Lab	CRA	99.7% 2 Sigma Calendar Age	Median
Beta Analytic Laboratory	900±30 BP	AD 1023-1225	AD 1123
PaleoResearch Institute	968±22 BP	AD 1011-1160	AD 1093
Geochron Laboratories	1020±20 BP	AD 969-1045	AD 1010

The BSDC is considered a 'young' artifact in terms of 14C radiocarbon testing; a 40,000-year old artifact can be more accurately dated than a 1,000-year old artifact. Therefore, determining which calendar age is the 'correct' age is not possible. With this in mind, MHM contends the BSDC could have been constructed as early as AD 969 or as late as AD 1225. However, MHM considers the AD 969-1045 date range to be reasonable considering the CRA and that it is a 99.7% 2 Sigma result. This date range places the dugout canoe in the Woodland Period of Minnesota's history.

²2 Sigma results at 99.7% or 95.4% probability indicates that if the same wood sample was analyzed several times, 99.7% and 95.4% of the results of the radiocarbon test will fall into those ranges. Similarly, 1 Sigma results indicate that after repeated analyses of the same sample, 68.2% of the measurements will fall within the range presented.

³Two weeks into their processing of the wood sample, PRI contacted MHM to acquire an additional wood sample. The lab believed that the sample collected on August 25 was to small for their testing process. MHM had also cleaned the BSDC of larger loose wood chips that had separated from the main body of the canoe over time. One of these pieces was send to PRI with the stipulation that only the uncontaminated core of the wood was used for testing.

⁴The BSDC was part of a larger study of MCHS's prehistoric artifacts in 2013; the canoe's wood type was determined to be white oak at that time (Bolten & Menk, Inc. 2013, 22).

⁵PRI's report on the radiocarbon results and wood typing characterizes the BSDC as a 'possible' dugout canoe; the artifact is *most definitely* a dugout canoe.

Woodland Period

The Woodland Period (BC 1000-AD 1750) in Minnesota is distinguished by the first pottery production, the construction of earthen mound-type graves, and the development of horticulture (Arzigian and Stevenson 2003, 79). Beyond these broad characteristics, the time span of the Woodland Period when compared to the date range of the BSDC is problematic when determining its possible cultural context. Big Swan Lake is in South Central Minnesota and is located in Minnesota archaeological region 4s⁶, the southern portion of the Central Lakes Deciduous Region. There are 11 recognized cultural complexes in the Woodland Period⁷ and this geographic position places the area around Big Swan Lake into 4 possible cultural complexes within the date range of the radiocarbon results (Arzigian 2008, 3-4). These cultural affiliations are the:

- Central Minnesota Transitional Woodland Complex: Middle to Lake Woodland in Central Minnesota (AD 300-1000)
- Southeast Minnesota Lake Woodland Complex (AD 500-1150)
- Blackduck-Kathio Complex: Lake [Terminal] Woodland in Northern and Central Minnesota (AD 600-1100)
- Psinomani Complex: Lake [Terminal] Woodland, Protohistoric, and Early Historic in Northern and Central Minnesota (AD 1100-1750) (Arzigian 2008, 2).

Known Woodland Period archaeological sites in the vicinity of Big Swan Lake include the Lake Koronis East burial mound group from the early Havana-Related Complex (BC 200-200/300 AD) that lies to the northwest of the lake. The Washington Creek Site (21-ME-14) also lies to the northwest of the lake and is associated with the earlier Fox Lake Complex (BC 200-700 AD) (Arzigian 2008, 52, 65). Other burial mound sites are located in Meeker County (21-ME-2, 21-ME-3, 21-ME-9, 21-ME-10, 21-ME-f), but no cultural affiliation beyond the broad Woodland Period label are associated with them. To the east of Meeker County, many Woodland Period burials mounds have been recorded in Wright County, but no cultural complexes have been associated with them (Arzigian and Stevenson 2003, 434, 525-527). Therefore, the specific Woodland Period culture associated with the BSDC cannot be determined, but archaeological evidence yet to be identified may assist in applying an attribution in the future.

⁶Minnesota has 9 archaeological regions: 1. Southwest Riverine, 2. Prairie Lake, 3. Southeast Riverine, 4. Central Lakes Deciduous, 5. Central Lakes Coniferous, 6. Red River Valley, 7. Northern Bog, 8. Border Lakes, 9. Lake Superior Shore (Anfinson 1990).

⁷Minnesota has 11 Woodland Period Cultural Complexes: 1. Brainerd Complex: Early Woodland in Central and Northern Minnesota, BC 1000-400 AD, 2. Southeast Minnesota Early Woodland Complex, BC 500-200, 3. Havana-Related Complex: Middle Woodland in Central and Eastern Minnesota, BC 200-200/300 AD, 4. Laurel Complex: Middle Woodland in Northern Minnesota, BC 150-650 AD, 5. Fox Lake Complex: Middle Prehistoric in Southwestern Minnesota, BC 200-700 AD, 6. Lake Benton Complex: Late Middle Prehistoric in Southwestern Minnesota, AD 700-1200, 7. Central Minnesota Transitional Woodland Complex: Middle to Late Woodland in Central Minnesota, AD 300-1000, 8. Southeast Minnesota Late Woodland Complex, AD 500-1150, 9. Blackduck-Kathio Complex: Late [Terminal] Woodland in Northern Minnesota, AD 100-1100, 10. Rainy River Late Woodland Complex: Late [Terminal] Woodland, Protohistoric, and Early Historic in Northern and Central Minnesota, AD 1100-1750.

3D Scanning

In 2016 MHM used a 3D scanning system to document the dugout canoe in more detail than was accomplished during the 2013 examination using digital photography. The BSDC was the first watercraft MHM documented in 3D and several scans were recorded on two different days to produce acceptable digital files. The files produced during this project will provide a baseline for future conservation treatments and cleaning of the artifact, assist the MCHS to track possible changes to the watercraft over time, provide a 3D printing template to produce miniatures of the dugout canoe, and serve as a model for future 3D scans by other professionals when constructing an interactive exhibit for the museum.









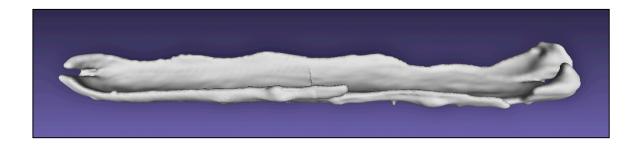
MHM's Christopher Olson in the process of scanning the Big Swan Dugout Canoe using a 3D scanner and iPad camera. MHM's Ann Merriman took care to stabilize the damaged end of the canoe in preparation for scanning (courtesy of Lori Pickell-Stangel).

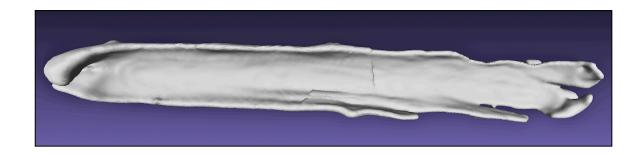
MHM created a series of images from the 3D scans of the BSDC by combining two digital files, a necessity due to the artifact's position. A difference in lighting can be seen as a line inside the hull.



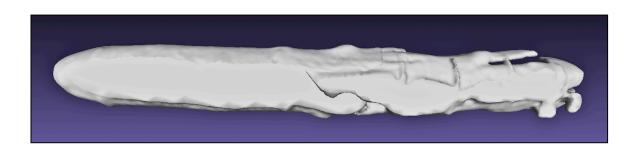
The bottom of the BSDC. The solid tan and brown sections in this scan represent areas that could not be scanned. The scanning software will fill in areas with a color similar to the scanned areas to complete the object.

Software can alter the color of the scans and allow the contours of the artifact to be seen.









Minnesota Dugout Canoe Chronology

Presented here are the 13 known and documented Minnesota Dugout Canoes ordered chronologically from oldest to youngest with their re-calibrated date ranges and their probable cultural affiliations noted.

Big Swan Dugout Canoe (21-ME-37)

McLeod County Historical Society 88.2266, Hutchinson Calendar Age: 1020±20 BP, 968±22 BP, 900±30 BP Date: AD 969-1045, AD 1011-1160, AD 1023-1225

Median Date: AD 1010, AD 1093, AD 1123

Woodland Culture







Lake Minnetonka North Arm Dugout Canoe (21-HE-438) West Hennepin History Center, Long Lake Calendar Age: 930±30 BP Date: AD 1020-1210

Median Date: AD 1099 **Woodland Culture**







Chippewa River Dugout Canoe

Chippewa County Historical Society 85.3.1, Montevideo Calendar Age: 400±30 BP Date: AD 1426-1530 Median Date: AD 1478

Woodland Culture, Possible Plains Village











Minnesota River Dugout Canoe (21-CP-72)
Chippewa County Historical Society 1998-0483, Montevideo
Calendar Age: 250±30 BP
Date: AD 1616-1685

Median Date: AD 1655 Mississippian Culture



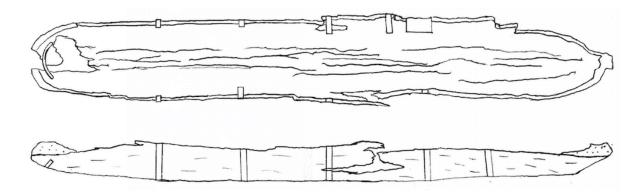
Lake Traverse Dugout Canoe-1

Browns Valley Historical Society, Browns Valley Calendar Age: 240±30 BP Date: AD 1616-1689 Median Date: AD 1663

Prehistoric/Prehistoric Sandy Lake/Protohistoric Dakota/Early Historic Dakota







Blue Earth County Dugout Canoe
Blue Earth County Historical Society 659.1, Mankato
Calendar Age: 140±30 BP
Date: AD 1665-1786



C. Maki Dugout Canoe (21-AK-bs)

Cokato Museum 76.4, Cokato Calendar Age: 150±30 BP Date: AD 1717-1890

Median Date: AD 1789

Ojibwe Culture



Minnesota River Valley Dugout Canoe

Bloomington Historical Society 64-1, Bloomington

Calendar Age: 130±30 BP Date: AD 1784-1894 Median Date: AD 1822



Lake Traverse Dugout Canoe-2

South Dakota Historical Society, Pierre, SD

Calendar Age: 130±30 BP Date: AD 1784-1894 Median Date: AD 1822







Rice Lake Dugout Canoe

Dodge County Historical Society 90.23.1, Mantorville
Calendar Age: 130±30 BP
Date: AD 1784-1894 Median Date: AD 1822







Beltrami County Dugout Canoe
Beltrami County Historical Society, Bemidji
Calendar Age: 80±30 BP
Date: AD 1800-1900 Median Date: AD 1846

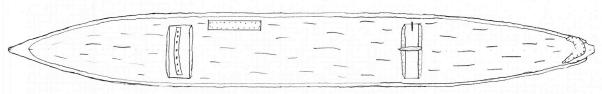
Ojibwe Culture



Root River Dugout Canoe
Houston County Historical Society, Caledonia
Calendar Age: 50±30 BP
Date: AD 1805-1905 Median Date: AD 1875 Ho-Chunk Culture







Lake Auburn Dugout Canoe
Minnesota Historical Society #9827, St. Paul

Calendar Age: 1933 Forgery or Replica



Minnesota Historical Society (HE5.19p18, digitized by MHM).

Conclusions

To more fully understand the cultural and archaeological information the BSDC provides, it is helpful to analyze and compare it to the other 12 known Minnesota dugout canoes. The 13 documented Minnesota dugout canoes were constructed and used by possibly 7 Native American and one European American cultures, they span approximately 1,000 years of Minnesota maritime history, and were used on waterways in 8 geographic areas. When considering the latest radiocarbon test results, the BSDC is the oldest known watercraft in Minnesota. The BSDC and the Lake Minnetonka North Arm Dugout Canoe (LMNADC, AD 1020-1210, Median AD 1099), essentially contemporaries in terms of age, have carved ends that are bluff (rounded) with a soft chine. A 1934 photograph of the LMNADC indicates that it probably had a definite bow and stern that are suggestive of the next oldest canoe, the Chippewa River Dugout Canoe (CRDC, AD 1426-1530, Median AD 1478). The current condition of the LMNADC does not reflect this similarity but it appears that one end of the inner hull was wider and more bluff, like the CRDC. The CRDC's ends exhibit what could be called partially-hard chines – not hard (sharp) but not rounded – a kind of intermediate form. The design of this canoe clearly suggests a bluff and wider stern coupled with a defined pointed bow. Moving on to the next oldest dugout, the Minnesota River Dugout Canoe (MRDC, AD 1616-1685, Median AD 1655), both its pointed ends are similar to the bow of the CRDC, although the ends are carved more thinly resulting in a lighter canoe. However, the MRDC does not exhibit a hard chine at either end, and this attribute is suggestive of the construction of the LMNADC and the BSDC. The bow design of the CRDC – pointed with a defined somewhat hard chine – would allow the watercraft to move more swiftly through water since there was less drag from the submerged section of the bow. The fact that this trait was not incorporated into the MRDC is curious, with one explanation being that its maker was less skilled than the CRDC's maker. The Lake Traverse Dugout Canoe-1 (LTDC-1, AD 1616-1689, Median 1663) is contemporary with the MRDC but a comparison of the construction attributes of one watercraft with the other is difficult due to the damage to the Lake Traverse example. However, the fashioning of the more complete end of the LTDC-1 is suggestive of both ends of the MRDC.

The Blue Earth County Dugout Canoe (BECDC, AD 1665-1786) is the sixth oldest known watercraft in Minnesota, placing it after the LMNADC, BSDC, CRDC, MRDC, and LTDC-1 chronologically. The MRDC is Mississippian, the LTDC-1's cultural affiliation (Prehistoric Sandy Lake Culture, the Protohistoric Dakota, or the Early Historic Dakota) is unsure because of its geographic location, and the BECDC may be Late Mississippian or it may be early Dakota. A painting of a Dakota canoe by Seth Eastman strongly resembles the BECDC and there is a good argument for the dating of the canoe to the Early Contact Period. The fine carving of the BECDC's ends suggests that a skilled workman produced the artifact. After the BECDC in the chronological order come the C. Maki Dugout Canoe (C.MDC, AD 1717-1890, Median 1789) and the Minnesota River Valley Dugout Canoe (MRVDC, AD 1784-1894, Median 1822). Unfortunately, the ends of the C.MDC and the MRVDC have not survived and cannot be analyzed for comparison to the other dugouts.

The Lake Traverse Dugout Canoe-2 (LTDC-2, AD 1784-1894, Median 1822) and LTDC-1, even with over 100 years of an age difference between them, are remarkably similar

in design. However, this fact might not be surprising since they were constructed and used on the same body of water. Further, the culture that produced both watercraft are probably the Protohistoric to Post-Contact Period Dakota, although the Prehistoric Sandy Lake culture cannot be ruled out in relation to the LTCD-1. The more complete condition of LTDC-2 may suggest what LTDC-1 would have looked like if it were in better condition. The Rice Lake Dugout Canoe (RLDC, AD 1784-1894, Median 1822) clearly incorporates hard chines on both ends, and while either end could be used as the bow or stern, one end is a bit broader suggesting it is the stern. The RLDC would have moved swiftly through the water with less drag than the other examples. Next, the Beltrami County Dugout Canoe (BCDC, AD 1800-1900, Median 1846) was created by the Ojibwe culture using a construction technique described by Charles Eastman in 1914. Further, the BCDC is remarkably similar to the MRDC – with the exception of the chisel tool marks - regardless of the geographic, temporal, and cultural affiliation differences between the two artifacts. The last documented Minnesota dugout canoe linked to Native Americans, the Root River Dugout Canoe (RRDC, AD 1805-1905, Median 1875) was probably constructed and used by members of a Ho-Chunk (Winnebago) band. This 19th Century watercraft's design and construction is similar to the older dugout canoes LTDC-1, BECDC, and LTDC-2. However, the RRDC's integrated thwarts offer a new attribute not seen in other Minnesota dugout canoes that may be culturally or geographically unique.

Lastly, Lake Auburn Dugout Canoe (LADC, AD 1933) has been confirmed to be a modern forgery – or at best a replica – by two radiocarbon tests using AMS. The intent of its maker was to deceive anyone who found the craft into perceiving it to be an artifact constructed by Native Americans. However, considering its age, it is now an antique and is a European American's 20th Century interpretation of the appearance of a Native American dugout canoe.

MHM is eager to document more dugout canoes and place them temporally, stylistically, and geographically into the system established through the comparison of the examples discussed here. The age of the artifacts, the attributes they exhibit, the geographic locations where they were discovered, and their condition further our knowledge about the people who constructed and used this earliest form of Minnesota waterborne transportation. With the revised radiocarbon date ranges for the BSDC, the age ranges of the 13 documented Minnesota dugout canoes is AD 969 to 1933. These watercraft, beginning with the BSDC, encompass over 1,000 years of Minnesota's maritime history and 12 of them represent the oldest known watercraft constructed in the State. Tool marks on both prehistoric and historic dugout canoes are tangible remnants of the production process, and their geographic locations can assist the archaeologist in determining the cultural background of their creators using radiocarbon dating. The information accumulated during the Big Swan Dugout Canoe: 3D Scanning and Radiocarbon Testing Project builds upon earlier studies and will augment future research efforts.

References

- Aitken, M.J. 1990. Science-based Dating in Archaeology. Longman: London.
- Anderson, Pam. 2010. Assessment Report of Selected Lakes Within the North Fork Crow River Watershed Upper Mississippi River Basin. Minnesota Pollution Control Agency: St. Paul, MN.
- Anfinson, Scott. 1990. Archaeological Regions in Minnesota and the Woodland Period. In *The Woodland Tradition in the Western Great Lakes: Papers Presented to Elden Johnson*, edited by G. E. Gibbon, pp. 135–166. University of Minnesota Publications in Anthropology No. 4. University of Minnesota, Minneapolis, MN.
- Arese, Count Francesco. 1934. A Trip to the Prairies and in the Interior of North America [1837-1838]: Travel Notes by Count Francesco Arese. Translated by Andrew Evans. Harbor Press: New York, NY.
- Arzigian, Constance M., and Katherine P. Stevenson. *Minnesota's Indian Mounds and Burial Sites: A Synthesis of Prehistoric and Early Historic Archaeological Data*. Minnesota Office of the State Archaeologist: St. Paul, MN.
- Arzigian, Constance. 2008. *The Woodland Tradition in Minnesota (ca. 1000 B.C. A.D. 1750)*. Multiple Property Documentation Form. Mississippi Valley Archaeology Center: La Crosse, WI.
- Bolten & Menk, Inc. 2013. McLeod County's Earliest Residents: Prehistoric Artifacts of the McLeod County Historical Society & Museum and the Relationship to the Pre-history of McLeod County. Bolten & Menk, Inc.: Mankato, MN.
- Eastman, Charles A. (Ohiyesa). 1914. *Indian Scout Talks: A Guide for Boy Scouts and Camp Fire Girls*. Little, Brown, and Company: Boston, MA.
- Featherstonhaugh, George W. 1847. *A Canoe Voyage Up the Minnay Sotor*. Volume II. Richard Bentley: London.
- Geochron Laboratories. 2016. *Radiocarbon Age Determination*. Geochron Laboratories: Chelmsord, MA.
- Hutchinson Leader. 1958, 16 January.
- Independent Review, The. 1958, 16 January.
- Klammerer, Paul W. 1934-1935. *Paul W. Klammerer Sketch Book, 1934-1935.* Minnesota Historical Society: St. Paul, MN.
- Kováčik, Peter. 2016. Wood Identification and AMS Radiocarbon Age Determination for a P0ssible Dugout Canoe Found in Big Swan Lake, Meeker County, Minnesota. PaleoResearch Institute, Inc.: Golden, CO.

- Minnesota Historical Society Photograph Collection. St. Paul, MN.
- Munter, Bob. 2003. Big Swan Dugout Canoe archaeological site number form, 21-ME-37. On file, Office of the State Archaeologist, St. Paul, MN.
- Schoolcraft, Henry R. 1852. *Information Reporting the History, Condition and Prospects of the Indian Tribes of the United States*. Part II. Lippincott, Grambo & Company: Philadelphia, PA.
- United States Geological Survey.1982. *Kingston, Minn. Quadrangle*. Geological Survey: Reston, VA.